

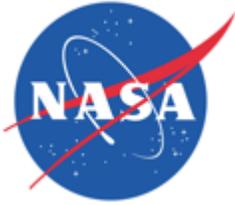
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Ground System Supply Chain Requirements Flow-Down for the Joint Polar Satellite System

Tim Bowser

Chief Safety and Mission Assurance Officer

October 22, 2014

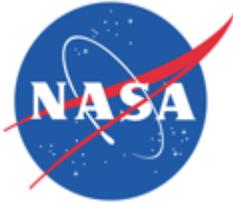


Where did we start?



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- Started with a Standard Flight MAR
- Converted to a JPSS Ground Specific MAR
- Incorporated Code 300 Ground MAR Recommendations
- Put JPSS Ground MAR on contract with Raytheon Common Ground System (CGS)
- Flow down appropriate MAR sections to Raytheon Subcontractors
- Verified flow down through Raytheon Subcontractor SOW's and MAIP Compliance Matrices
- Performed Independent NASA Audits (Code 302 and On-site)
- Applied Lessons Learned and Updates



Flow Down



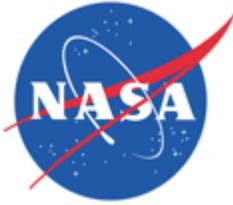
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•JPSS Ground Mission Assurance Requirements (MAR) Doc # 474-00177

- Applicable to the following JPSS Ground development entities:
 - Raytheon Common Ground System (CGS)
 - Data Products Engineering & Services (DPES), Government Resource for Algorithm Verification, Independent Testing, and Evaluation (GRAVITE), Field Terminal System (FTS)
 - JPSS Flight Vehicle Simulator (FVS) and Flight Vehicle Test Suite (FVTS)

•JPSS Ground Mission Assurance Implementation Plan (MAIP)

- Defines common approach/activities “How To” document and each element above has its individual MAIP
 - Includes MA objectives and fundamental
 - Provides reference to subordinate MA/QA plans
 - Describes organization structure and roles and responsibilities
 - Implementation enforced via the MAR compliance matrix
 - Data Item Description (DIDs) as applicable to the JPSS Ground MAR
 - Supplier MAR Compliance Matrix also flown down and verified
 - Updates being provided as required



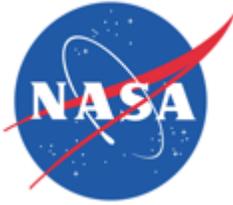
Provisions



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•JPSS Ground MAR Provisions

- Increased Quality involvement in JPSS Ground System
- MAR applicable to Prime & subcontractors
- Support NASA conducted audits, assessments, or surveys
- Comprehensive System Safety, RMA, and Software Assurance programs
- Participation in NASAs Integrated Independent Review Program
- MRB membership including Government representative as a voting member
- GIDEP & NASA Alert assessments
- Mishap reporting and investigation
- Calibration and ESD
- Comprehensive End Item Data Package
- GSFC 'Gold Rules'
- Participation in risk management process
- Supplier Quality

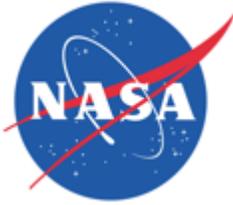


Verification



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- NASA Code 302 Audit of Raytheon/Aurora Common Ground System-June 2013 and 2014
- NASA MA In-Plant Software and Hardware Assurance Oversight and Internal Audit
- Fairbanks Command and Data Acquisition Station (FCDAS) Antenna Installation
 - Pre-Ship Review at L3/ Datron, Simi Valley, CA
 - Oversight to the successful installation and site acceptance testing of the new “4A” antenna, Fairbanks, Alaska
- Svalbard, Norway (KSAT)
 - SG-60 Installation
 - Participation in the PSR of new receptors planned for Svalbard (SG-60)
 - Oversight to the successful installation and site acceptance testing
 - SG-4 Refurbishment
 - L3/Datron Gear replacement for SG-4
 - Participation in planning/coordination discussions
 - Review of safety procedures
 - Safety and Mission Assurance Oversight during installation
- Raytheon Common Ground System Block 2.0 Hardware shipment/receipt/installation
- GRAVITE, FVS and FVTS upgrades



SMA Facility Oversight NOAA Satellite Operations Facility (NSOF)

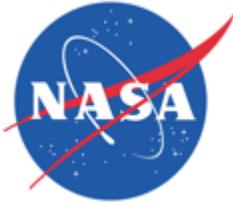


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- **Monitoring of ongoing GSA conducted facility improvement efforts**
 - **On-site x-raying evaluation survey to verify safety procedures and precautions**
 - **Data Center Core Drilling**
 - **Installation of pipes**
- **Review of ESD procedures**
- **Receipt/Inspection/Placement of Block 2.0 Hardware**
- **Hardware Installation and audits**





SMA Facility Oversight NOAA Satellite Operations Facility (NSOF)



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Interface Data Processing Segment (IDPS)



GRAVITE Servers



Command, Control and Communications Segment (C3S)



NASA and Raytheon Safety and Mission Assurance witnessed all installation of new equipment and continuously monitors existing equipment in concert with NOAA facilities management and safety.



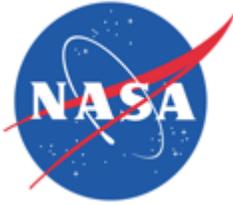
Key Supplier Site Visits and Partnerships between Raytheon/NASA/Vendors



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**Situational Awareness and Improved Communications
on Network Services**



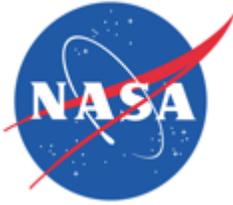
4A Antenna Installation NOAA Gilmore Creek Fairbanks, Alaska July 2013



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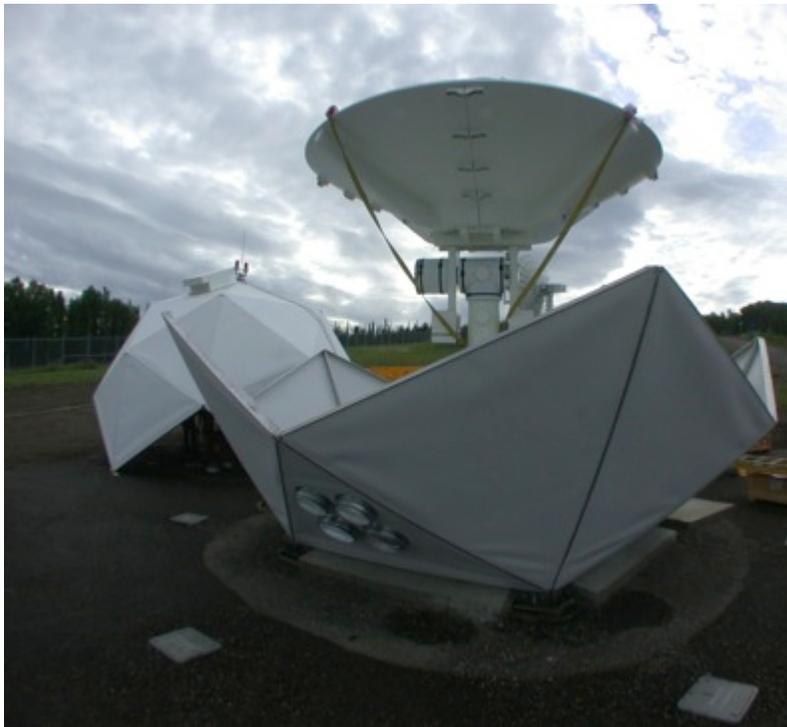
- **Performed independent safety oversight of Fairbanks Receptor Deployment and Installation**
- **Lessons Learned from this antenna installation captured to assist in the SG60 Antenna Installation in Svalbard, Norway**
- **Review of site safety hazards and mitigations for future activities**



4A Antenna Installation NOAA Gilmore Creek Fairbanks, Alaska July 2013



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L3/Datron Installed.
Raytheon Site Acceptance.
NASA SMA witness.

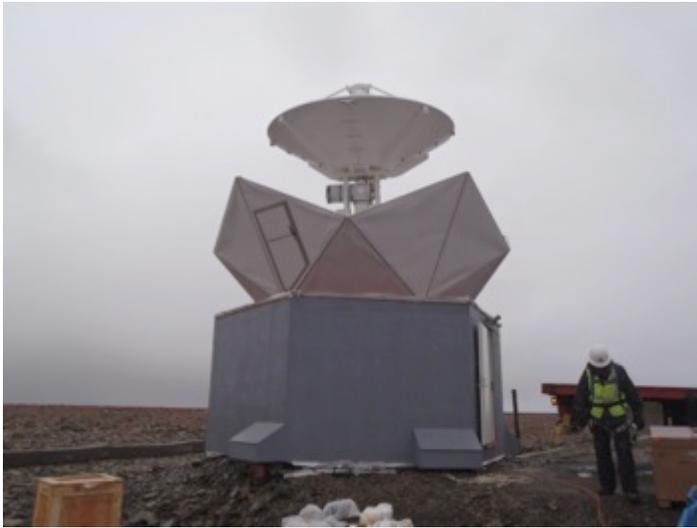




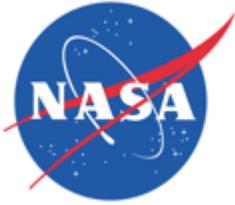
SG-60 Antenna Installation Svalbard, Norway August 2013



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**L3/Datron Installed.
Raytheon Site Acceptance.
NASA SMA witness.**



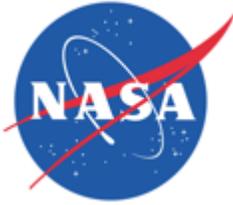
SG-4 Antenna Refurbishment May 2014



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**Kongsberg Satellite Services (KSAT)
Svalbard, Norway**



SG-4 Antenna Refurbishment

May 2014



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- **Replace 6 Gears**
- **2-Elevation, 2-Azimuth, 2-3rdAxis**
- **Replace 6 Brushless Servo motors**
- **2-Elevation, 2-Azimuth, 2-3rdAxis**
- **Replace 3 Servo Cabinets**
- **Elevation, Azimuth, 3rd Axis Servo Cabinets**
- **Replace 1 DEU**
- **Replace 1 Tracking Receiver**
- **Clean and Dress Bull Gears**
- **Perform scheduled maintenance**





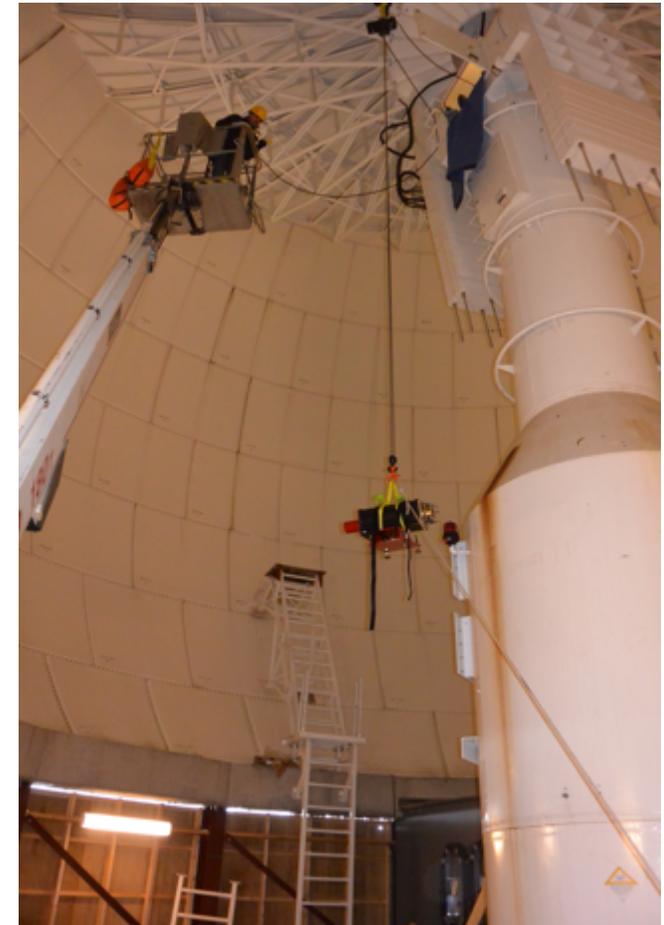
SG-4 Antenna Refurbishment May 2014

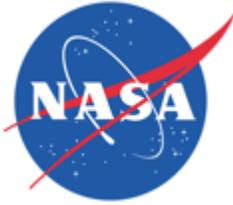


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Removal of Elevation gear and motor





Summary



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- Developed Safety and Mission Assurance Requirements for a Significant Ground System that covers several missions
- Infused Safety, Quality, Reliability, Availability and Maintainability into typical COTS type products
- Identified and Mitigated 77 Safety Critical Hazards, 5 of which included Flight Commands and Controls
- Eliminated Single Points of Failure through Ground Availability Reliability Working Groups (FTA's/FMECA's)
- Validated and Verified the Implementation of the Mission Assurance Requirements Flow Down to Prime, Subcontract and Site Support Contractors
- Witnessed Deployments to Assure Quality and Ensure Safety